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Occupational Outlook Quarterly

Fall 2009 • Volume 53, Number 3

2 Careers in auto racing: Work in the fast lane by William Lawhorn

The person behind the wheel is just one of many driving the sport of auto racing. Learn about workers on the track and in the shop who contribute to the thrill of race day.



10 Metrology careers: Jobs for good measure by Drew Liming

Heavy and light, fast and slow, narrow and wide, big and small: The long and short of it is that metrologists measure them all.



16 Grab Bag

Training aid for military spouses, engineering scholarships for railroad careers, training for wind turbine technicians, and distance education.



18 Patent work: The other side of invention by Tamara Dillon

It's a good idea to protect a good idea. Patent workers ensure that inventors' inspirations are original—and safe from imitators.



26 Gap year: Time off, with a plan by Elka Maria Torpey

Whether it's to travel, work, or consider your next move, taking time off can be fulfilling. Having a plan can help you avoid pitfalls.



34 You're a *what*? Solar photovoltaic installer by Elka Maria Torpey

Rebekah Hren works to save the planet, one solar panel at a time.



h Tapscott, Design consultant 36 OOChart

Large occupations with higher-than-median wages, May 2008



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CAREERS IN AUTO RACING: WORK IN THE FAST LANE

William Lawhorn

ong before most people had seen an automobile, thrill-seekers across the globe were driving cars competitively. The first recorded auto race in the United States took place in 1895 in Illinois. The winner covered the 54-mile course in a little more than 10 hours.

The speed of racecars has accelerated steadily since then, as has the popularity of the sport. In public opinion polls of sports popularity, in fact, auto racing consistently finishes near the top. And racecar drivers may be the star of their event, but they depend on support from many others—including some workers who aren't on the track.

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The person behind the wheel is just one of many driving the sport of auto racing. Learn about workers on the track and in the shop who contribute to the thrill of race day.

You don't have to be behind the wheel to pursue a career in auto racing. From pit crews to promoters, a variety of workers contribute to the excitement of race day. The following pages provide information about occupations in the racing industry. After an introduction to the sport, you'll read about what these workers do, either on the track or in the workshop, and how they train. And you'll learn where to find more information.

Types of auto racing

Modern motorsports are a vast industry. Professional drivers compete for prize money known as a purse—in everything from gokarts to tractor-trailers. In the United States, however, three types of motor racing are most prominent: stock car, open wheel, and drag.

Stock car racing features cars that are based on commonly manufactured production vehicles sold to the public. Stock racecars range from those that are minimally modified to those that are custom-built and share only their external appearance with production vehicles. Races generally are held on oval tracks with steeply banked turns.

The National Association for Stock Car Auto Racing—better known as NASCAR—is the most prominent stock car racing organization. But there are several smaller, usually regional, stock car associations. These organizations often serve as a training ground for racers and crews who later rise to prominence on the NASCAR circuit.

Open-wheel racing features custom-built racecars with exposed wheels and an open cockpit. The most prominent open-wheel racing organization in the United States is the Indy Racing League. Most Indy races are on oval tracks. A few races, however, are held on closed public streets or on courses built to mimic public streets.

Drag racing is a form of organized racing in which two vehicles race along a straight course—a drag strip—that is usually a quarter-mile long. Cars in drag racing range from stock production autos to highly specialized, custom-built vehicles.

Most drag races in the United States are governed by the National Hot Rod Association. A smaller organization, the International Hot Rod Association, governs nearly all remaining U.S. drag races.

On the track

According to the 2009 National Speedway Directory, there are about 1,800 racing venues throughout the United States, and every event requires drivers and pit crews.

The specifics of the track and pit depend on the type of car being raced. Speed enthusiasts, for example, might be drawn to drag racing, in which cars with 7,000-horsepower engines reach speeds of 330 miles per hour. Other races have different paces and require different skills—from both drivers and crews.

Racecar driver

A racecar driver maneuvers his or her car through the course, around the track, or up the strip—at the fastest possible speed. To do this, the driver must remain acutely aware of track conditions and the position of other drivers.

All drivers make quick decisions about shifting gears, braking, and accelerating. Then, they execute these tasks while travelling at high speed. They must understand the geometry of the racetrack to move efficiently.

While successfully maneuvering past a competitor, drivers must also prevent other competitors from passing them. Drivers consider every detail, from the position of their own bodies to weather conditions, and constantly reevaluate and monitor the performance of their car.

Racecar drivers must skillfully maneuver cars at high speed.



In stock car and open-wheel racing, drivers seek maintenance in the designated "pit" area of the track. To make these pit stops, drivers must position their car properly when entering the pit area, because misalignment costs time.

And drivers don't just drive; they also make special appearances to promote their team, sponsors, and racing organization. Like other professional athletes, racecar drivers answer fans' questions and sign autographs.

Pit crew

The pit crew is a vital part of the racing team. These workers take care of the racecar's mechanical needs during pit stops. Pit stops usually involve refueling, tire changes, and mechanical repairs.

Depending on the length of the race, the driver may need to make several pit stops. The type and size of car, the volume of fuel it holds, and the length of the race determine what type of work must occur during a pit stop.

While stopped, drivers lose their race position relative to other drivers. Therefore, it is critical that pit stops are completed as quickly as possible. A standard pit stop takes about 15 seconds, in contrast to more than a minute in racing's early days. Not surprisingly, crew members are usually physically fit; some are former college athletes who have the

> strength and agility to perform pit tasks quickly and accurately.

The planning of pit stops is a key part of racing strategy. Before a race, the pit crew ensures that the car is mechanically sound and that all fuel, tools, parts, and equipment needed for pit stops are in place. During the race, the crew works to keep the car running; afterward, there's cleanup and evaluation of performance. Between races, they practice pit stops.

Below are job descriptions for several members of the pit crew.

U.S. Air Force photo by Daniel Elkins



On the track, pit crews take care of their team car's mechanical needs.

Crew chief. This worker plans and organizes all race preparations. Duties vary, depending on the type of race. For example, a crew chief on a hot rod may also be involved in the tuning of the engine prior to the race. On some stock car teams, the crew chief manages work schedules, handles employee training, and is a parts supply liaison.

Pit coach. Major stock racing teams have a pit coach, who is responsible for ensuring smooth pit stops. Job tasks may include developing weekly pit practices and workouts. In top-level racing series, pit crews have a full-time training regimen because every fraction of a second is important and requires preparation.

Gas person. In longer races, cars need to be refueled. A gas person handles the fueling of the car. Fuel is held in containers that keep an exact amount of fuel. After the pit stop, the gas person measures the amount of remaining fuel to calculate when the next pit stop must occur.

Jack operator. This worker operates the jack that lifts the car so the tires can be changed. The driver knows it is safe to go when the jack operator drops the car after changing the last set of tires.

Tire carrier, changer, and catcher. A tire carrier brings tires to the front and back of the car and assists the tire changer in replacing them. Tire changers operate the air gun that loosens and tightens the lug nuts. Changers then roll the used tire toward a tire catcher, who removes it from the pit area.

Windshield cleaner. The windshield cleaner ensures visibility by washing the windshield to remove buildup such as dirt, oil, rubber, and bugs that have accumulated there.

Mechanic. Pit mechanics specialize in either under-car or front-end setups. The under-car specialist is concerned with the engine, transmission, and other drivetrain components. The front-end specialist insures that various parts of the car associated with tire alignment are properly adjusted.

Some auto racing mechanics also have jobs in the workshop. Their tasks are described in the section on shop workers.

Scorer and spotter. A scorer tracks the lap times for the car to help determine speed and total racing time. The spotter stays in communication with the driver during the race and informs the driver of any issues on the track, such as oil spots, crashes, and competitor positions.

In the shop

All racecars start in the workshop—more commonly known as the "shop"—and end up back there. Most shops have specific areas dedicated to fabrication, mechanics, paint, parts, and engines. Shop workers prepare more than one car for a race, because teams need to have a backup ready for each event. And teams often tailor car preparation to specific tracks.

Occupations

In-shop workers include mechanical engineers, mechanics, fabricators, and painters. All of them are supervised by a shop foreperson.

Shop foreperson. The shop foreperson plans and coordinates all the activities of shop workers. The foreperson also acts as a liaison between the shop workers and the trackside crew chiefs and addresses problems the chief notices during a race.

Mechanical engineers. Mechanical engineers develop, design, and test new auto bodies, engines, and tools. Using design software, these workers create the plans that mechanics and other technicians use when producing parts and assembling the vehicles. Engineers consider every aspect of a car's design, from aerodynamics to engine torque. They also factor in safety considerations.

Mechanics. Mechanics prepare the cars for races. They diagnose mechanical problems, tune the engine, adjust chassis and wheel alignment, and perform many other tasks that help performance.

Racing mechanics are often specialized. Examples include engine tuner and suspension specialist. Constant repetition with the same product allows mechanics to complete work quickly and efficiently. Their knowledge and skills depend on the rules of the various racing series. But diagnostic skills are important for mechanics in auto racing to maximize performance.

Fabricators. Fabricators create the highly specialized pieces of the racecar, repair autobody damage, and make adjustments to reduce the body's contact with the track. By cutting and welding prefabricated parts, fabricators create the pieces a particular racecar needs.

Body hangers. Body hangers attach the autobody shell to the car's frame. Strict standards apply to fitting metal templates to specific points on the car. Manufacturers have specialists perform this task for race shops, but some shops also employ their own body hangers.

Painters. Painters apply the base colors and coatings to racecars. Almost every part of a racecar is painted in a process that takes about 2 days. A recent time-saving innovation involves "wrapping," covering all or part of the car in vinyl. Wrapping makes it possible to change a car's color scheme in 4 hours or less.

Shop mechanics may have

to repair car parts damaged

during an event.



Employment and wages

The U.S. Bureau of Labor Statistics (BLS) does not have employment and wage data specific to occupations in auto racing. Businesses involved in the operation of auto races including racing teams—are classified within the spectator sports industry. But this industry also includes nonracing sports businesses. In addition, establishments classified in other industries provide support to the auto racing industry. As a result, BLS can't determine exactly how many workers are employed in auto racing.

But many of these jobs are specialized versions of occupations for which BLS does have data. And because employees of racing teams are classified within the spectator sports industry, wages for racing-related occupations within that industry are the best approximation of wages for those in the auto racing industry. Median annual wages for selected occupations are presented in the table below.

Drivers compete professionally in venues ranging from rural dirt tracks to modern speedways. Some are part-time drivers racing for purses that barely cover their expenses; others get staggering sums that they supplement with income from product endorsements. Prominent professional drivers usually have a contractual agreement with a sponsor or racing team owner, and they receive a percentage of the prize money. Top NASCAR drivers, for example, might receive between 40 and 50 percent of the purse, with team sponsors, owners, or members splitting the remainder.

Preparing for a career in auto racing

Preparation for a career in auto racing often starts with interest in the sport at an early age. And that interest may be paired with automotive knowledge developed through exposure to engines: growing up around machinery on a farm, perhaps, or mechanical training during military service.

Auto racing workers sometimes have similar knowledge and skills, but specific

education, training, and requirements vary by occupation. Racecar drivers, for example, must have highly developed driving skills but do not need a college degree. Mechanical engineers, on the other hand, must have a bachelor's degree. Advancement opportunities also vary.

Skills

Familiarity with car engines, bodywork, and mechanical technology is common among workers in auto racing. Strong math skills are essential for making calculations, such as those for fuel consumption or for measuring a car's clearance, during an event. And proficiency in the use of testing and diagnostic equipment is useful for vehicle maintenance.

Communication skills are important for most workers in racing occupations, especially for racecar drivers and shop workers. In addition to communicating with the pit crew during a race, drivers are expected to make public appearances off the track and must be able to relate to fans and the media. Shop workers need to interact with each other to prepare vehicles for an event.

Management skills are a must for a foreperson, who functions as the shop supervisor. In addition to their knowledge of shop operations, which they usually gain through on-thejob experience, forepersons should know how to direct shop workers. They need leadership, problem-solving, and communication skills, as well as the abilities to coordinate work, set priorities, and motivate others.

Athletic ability is necessary for pit crew workers. They need strength and coordination

Median annual wages for selected occupations in the spectators sports industry, May 2008

Automotive body and related repairers	\$54,750
Automotive service technicians and mechanics	51,160
First-line supervisors and managers of mechanics, installers, and repairers	67,960
Helpers of installation, maintenance, and repair workers	23,780
Machinists	45,060
Mechanical engineers	78,320
Painters of transportation equipment	52,870

to perform their tasks—including lifting and carrying heavy equipment—quickly, safely, and accurately. Many crew members have participated in formal athletic programs in other sports.

Education and training

Although students interested in auto racing often start honing car skills well before their teen years, by high school they should take certain classes if they expect to make a career in racing. Math is a must, but vocationaltechnical courses are also important. Postsecondary coursework may also be required, especially where vocational courses are not offered in high school.

To become a mechanic, students should take automotive maintenance and repair courses. Manufacturers' specialty courses and automotive mechanics courses include more in-depth information about vehicles. These courses are valuable not only for mechanics but often for drivers, fabricators, and painters as well. Technical preparatory schools, such as the NASCAR Technical Institute, specialize in racing technology education.

Fabricators need coursework in welding and metalworking, particularly specialized welding and sheet metal. Modern race teams often construct their own parts, so certification in specialized welding is useful. On-the-job training is also common for fabricators.

Painters may find it helpful to take vocational-technical courses in automotive body painting. Some schools maintain facilities to paint cars as well as to perform basic body repairs. Many painters also learn on the job.

Drivers must complete courses to get licensed in operating high-speed vehicles. In addition, drivers often take courses to maintain their driving skills or to eliminate problems that develop. There are numerous schools that help racecar drivers improve their skills.

Mechanical engineers need to earn at least a bachelor's degree, most commonly in mechanical engineering, from an accredited university. Programs tailored to the automotive industry are available at some

universities; a few graduate programs also exist. Continuing education courses are available through professional associations.

Advancement

Opportunities for advancement for workers in auto racing are often tied to experience and networking—and, sometimes, geographic location. But some occupations have more specific paths for moving forward.

Most racecar drivers, for example, don't begin on the big tracks. Drivers might get their start racing go-karts and later work their way up from lower-level auto races. By gaining experience and taking specialized courses, drivers are able to control faster and more powerful cars as they advance in auto racing.

Shop forepersons usually work their way up from the shop floor to management. Through experience, they gain knowledge of each shop worker's job and then apply that knowledge to running the shop efficiently. Along with shop experience, though, forepersons need expertise in racing. They might spend time on the track or as a crew chief.

Other workers in auto racing advance by gaining experience on the job. Many have opportunities through family- or friend-owned businesses and projects. In fact, networking is an important element of advancing in auto racing. Workers should develop contacts and be prepared to use them. By starting at a local track and working their way up, they can expand their list of connections.

Geographic location is a factor in auto racing, and achieving success may require relocating. In the case of NASCAR, for example, most team shops are located near Charlotte, North Carolina, so workers who want to rise to NASCAR ranks must live there.

For more information

To learn more about careers in auto racing, visit your local library. Look for resources about the occupations described in this article, as well as about the auto racing industry itself.

Many of these occupations have counterparts outside of racing, and the Occupational

Outlook Handbook has descriptions of them. The descriptions include working conditions, job duties, employment, wages, training requirements, and more. Find the Handbook in libraries or online at www.bls.gov/ooh.

Professional associations also offer career information for people interested in racing. Many provide news about drivers, racing schools, and job openings.

For general information and racing news, contact:

National Speed Sport News P.O. Box 1210 Harrisburg, NC 28075 Toll free: 1 (866) 455-2531

www.nationalspeedsportnews.com

For information about engineers, contact: American Society of Mechanical Engineers 3 Park Ave. New York, NY 10016 Toll free: 1 (800) 843-2763

www.asme.org

SAE International 400 Commonwealth Dr. Warrendale, PA 15096 (724) 776-4841 www.sae.org

For information about mechanics, contact: National Automotive Technicians **Education Foundation** 101 Blue Seal Dr. SE. Suite 101 Leesburg, VA 20175 (703) 669-6650 www.natef.org

Universal Technical Institute, Inc. NASCAR Technical Institute 220 Byers Creek Rd. Mooresville, NC 28117 Toll free: 1 (877) 201-2597

www.uti.edu/NascarTech/tabid/58/ **Default.aspx** ∞

U.S. Air Force photo by Larry McTighe



METROLOGY CAREERS:



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hat kind of career rewards precision and accuracy? One in metrology—the science of measurement. By evaluating and calibrating the technology in our everyday lives, metrologists keep our world running smoothly.

Metrology is used in the design and production of almost everything we encounter daily, from the cell phones in our pockets to the walls of our homes.

JOBS FOR GOOD MEASURE



But it isn't always easy to classify the workers who apply metrology in their jobs. Metrology workers are employed in a variety of industries and have different job duties. For example, both scientists conducting research in a laboratory and technicians supervising production on a factory floor might rely on knowledge of metrology. And because metrologists come from diverse educational backgrounds, many learn their skills on the job.

This article introduces metrology as a career field. The first section defines the different types of metrology. The next section describes five industries in which metrologists are employed and some of the work they perform in each. The third section discusses skills and training metrologists often have, along with some of the ways they typically advance in their careers. Sources of additional information are provided at the end.

TYPES OF METROLOGY

In the United States, metrology standards are determined by the National Institute of Standards and Technology.

There are three different types of metrology: scientific, legal, and industrial. Scientific metrology focuses on developing new systems of measurement and standardizing existing ones. Legal metrology is concerned with regulating measurements and measuring instruments related to public policy issues, such as preserving public safety and health. Industrial metrology applies the principles of measurement science to manufacturing.

Workers in scientific and legal metrology are usually employed by government agencies. But most metrology workers have jobs in industrial metrology, where they test new products for private companies as well as for government. For example, an industrial metrologist working in the automobile industry may design an evaluation for a car's crash detection system. And another industrial metrologist, employed in government, might verify that the system works correctly.

Classifying metrology jobs is difficult because of these workers' varied skills, educational levels, and positions. There are also some occupations in which metrology skills are only part of the job: An electronics engineer designing microchips, for example, might occasionally perform metrology tasks but has many other duties as well.

And metrology workers may have different titles, depending on their industry and employer. Other job titles might include calibration engineers, calibration technicians, quality engineers, quality technicians, process control technicians, and safety engineers.

METROLOGY AT WORK

Because metrology work is often interspersed with other job duties and occupational titles, the U.S. Bureau of Labor Statistics (BLS)

> does not collect employment or wage data specifically on metrologists. Metrology, however, is critical to the success of many different industries. Metrologists help to develop technology by designing or performing tests to determine a product's effectiveness. They also calibrate existing devices, such as fuel gauges or radio antennas, to keep them in working order.

There are many industries that employ metrologists. In the following industries, descriptions of metrology work provide a glimpse of the broad range of projects that rely on the science of measurement.

Aerospace. Complex machinery like airplanes requires metrology workers to consider both function and safety. Metrologists in aerospace supervise the manufacture of planes and are responsible for testing their components, including turbines and landing gear. Calibration technicians also regularly check the assembly process to

ensure that the machinery is functioning correctly.

Metrologists' contributions to the aerospace industry extend beyond structural assembly. For example, the instruments in a cockpit, such as the navigation system and altimeter, are subject to metrologists' review and calibration. Metrology also helps to ensure the safety of passengers inside the plane. Fabric in the plane's cabin is designed to be fire resistant, and metrologists set standards for measuring flammability and help test and develop new flame-retardant products.

Communications. Without metrology, dependable and secure digital networks couldn't exist. In computer network security, for example, metrologists thwart hackers by developing new programs to measure network activity and flag suspicious actions.

Cell phone production also benefits from metrology work. Metrologists help test the phones' numerous components, recording under what circumstances the phones can function.

Construction. Metrology aids the construction industry in a number of ways. Metrology tools developed for building managers help them determine the costeffectiveness of worksite decisions. By researching new methods to automate the construction process, metrologists help reduce labor costs. And the production of cheaper, more resistant building materials relies on measurement science.

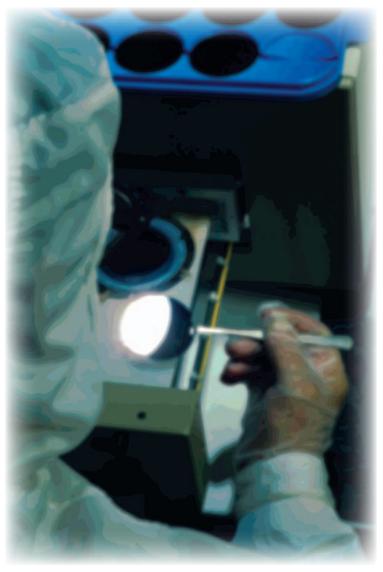
Metrologists also are involved in building design and may study structural durability. To help guide construction standards, metrology workers develop tests to evaluate a structure's resistance to daily stress from both people and the environment. For example, metrologists create trials to measure a home's resistance to earthquakes and fires.



Energy. All energy companies rely on the work of metrologists. Every building has a meter that displays its energy consumption, and calibration technicians ensure that these meters provide accurate readings. Consumption measurements are the underpinning of the energy industry; without them, energy companies wouldn't be able to charge customers by use.

In a power plant, calibration technicians are also needed to continually verify its many gauges and measurements. The potential consequences of a power plant failure range from loss of electricity to nuclear meltdown.

Metrologists are also involved in "green" energy. They help develop wind turbines and solar panels by testing energy output and construction methods. And metrology is critical for measuring the power consumption of new energy-efficient household appliances.



Healthcare. For many patients, the proper functioning of medical devices is a matter of life and death. And metrologists are required to calibrate and certify medical devices, such as external pacemakers and fetal monitors. By fine tuning machinery, metrology workers ensure the accuracy of medical tests to allow for the best possible diagnoses.

SKILLS, TRAINING, AND **ADVANCEMENT**

Workers in metrology often follow indirect career paths to their jobs. There are, however, some skills and training common to workers in metrology occupations. And experience may lead to increased responsibilities in other metrology work.

Skills. Highly skilled metrologists—those developing new tests and product designs in laboratories—must be proficient in mathematics, the sciences, and engineering. They must also have excellent communication skills, because they often work on teams with other researchers and scientists.

Metrologists at the technician level need mechanical aptitude. Technicians also must be able to maintain high levels of concentration while making slight, precise adjustments to equipment.

Training. Unlike other sciences, metrology has a relatively low profile with few formal education programs. There are several degree programs for metrologists at the associatedegree level. Some 4-year universities offer metrology specializations in their engineering departments.

Many metrologists who have a bachelor's or higher degree study a science or engineering discipline other than metrology. Some research metrologists, for example, might have a physics or mechanical engineering degree. Others have a degree specific to the industry in which they are employed; for example, metrologists working in the aerospace industry might have a degree in aerospace engineering.

Metrologists at the technician level usually don't need a degree. Most have a high school diploma and receive on-the-job training. The U.S. military also offers many training programs in the study of metrology.

Advancement. Assuming more responsibility in jobs related to metrology, like jobs in many fields, often depends on gaining experience. Technicians may advance to more sophisticated metrology jobs with experience and instruction, including through formal or informal mentorships. For example, a quality control technician working on a factory floor might be coached to consider more complex design issues.

Mid-level metrologists might work as technicians or scientists, but either worker may find advancement to other metrologyrelated jobs. Because of their expertise, the most experienced usually work as managers or supervisors of other metrologists.

FOR MORE INFORMATION

To learn more about careers in metrology, refer to the BLS Occupational Outlook Handbook. As mentioned previously, BLS does not collect employment and wage data specifically on metrologists. However, data are available for some other occupations that may include performance of metrology tasks, such as inspectors, testers, sorters, samplers, and weighers (see www.bls.gov/oco/ocos220. htm) and engineering technicians (see www. bls.gov/oco/ocos112.htm).

The *Handbook* is available in many public libraries. Online, visit www.bls.gov/ooh.

Some associations that might provide more information on metrology work and education include the following:

National Institute of Standards and Technology 100 Bureau Dr. Gaithersburg, MD 20899 (301) 975-6478 inquiries@nist.gov www.nist.gov

American Society for Quality

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Serving the spouses of those who serve

The hardships of military life often extend to the families of service members. The education and careers of military spouses, for example, might suffer setbacks due to periodic transfers. Relocating spouses may have trouble finding a job, or they may discover that their professional licensure or certification is no longer valid in their new location.

But a newly expanded program helps spouses train for or maintain careers that will travel with them. The Military Spouse Career Advancement Account (MyCAA) began as a pilot program in eight States and was recently expanded for military spouses worldwide. MyCAA is designed to equip spouses for "portable" careers: jobs for which there are broad opportunities.

MyCAA provides up to \$6,000 in financial assistance for education, licensing, and credentialing. Assistance is available for any occupation within several high-growth industries or for select in-demand occupations within other industries.

All spouses of active duty service members and activated reservists are eligible for the program, provided that the spouses are not members of the military themselves. To set up an account, eligible spouses should visit the MyCAA Web site at https://aiportal.acc.af.mil/mycaa. If you have questions, call toll free, 1 (800) 342–9647 and ask for a Military OneSource career and education consultant.

Engineering a railroad career

If you're an engineering major, consider a railroad track—as a career track, that is. The American Railway Engineering and Maintenance-of-Way Association Educational Foundation might even provide money for you to train.

The foundation, a charitable organization promoting railway engineering education, offers a range of scholarships for engineering students who are interested in working in the railroad industry. Individual awards range from \$1,000 to \$5,000.

All applicants must be enrolled in an accredited 4- or 5-year program that leads to a degree in engineering or engineering technology and must maintain a minimum 2.0 grade point average. Applicants must also submit a resume and a brief cover letter describing an interest in railroading and explaining why they deserve a scholarship.

Information and application materials are available on the foundation's Web site, www.aremafoundation. org, or by calling Stacy Spaulding at (301) 459–3200.



Your future career: Blowin' in the wind?

Strong winds are blowing change into the energy industry, creating new careers. According to the U.S. Department of Energy, wind power is the fastest growing energy source in the country. As the industry expands, so does the need for technicians to install, operate, and maintain wind turbines.



Wind turbine technicians build or service individual turbines, help with the construction of entire wind farms, or work indoors at factories that manufacture wind turbines. These technicians use a range of mechanical, hydraulic, and electrical skills. Except for those working in factories, wind turbine technicians spend a good deal of their time outdoors and working atop wind towers. Therefore, these technicians should be comfortable with heights.

An increasing number of educational institutions offer wind turbine technician degree or certificate programs. The U.S. Department of Energy maintains a list of schools that offer training in wind turbine technology and other wind energy occupations. That list is available online at www.windpoweringamerica.gov/schools_training.asp.

For more information about the wind power industry, contact the American Wind Energy Association, 1501 M St. NW., Suite 1000, Washington, D.C. 20005; (202) 283-2500. Or visit online at www.awea.org.

To learn about some other energy careers, see "You're a what? Solar photovoltaic installer," elsewhere in this issue of the Quarterly, and "On the grid: Careers in energy," in the fall 2008 Quarterly and online at www.bls.gov/oog/2008/fall/art02.pdf.

Learning from a distance

Busy schedules, difficulty in traveling, and lack of accessibility to courses used to hamper educational efforts. Not anymore.

Distance education, defined as a formal education process in which the student and the instructor are not in the same place, makes learning available to a range of students.

According to National Center for Education Statistics (NCES) data, two-thirds of degree-granting 2- and 4-year postsecondary schools offered online or other distance education courses in 2006–07, the most recent year for which data are available. During that year, distance education courses accounted for about 12.2 million enrollments. This figure represents more than 16 times the number of enrollments in 1994-95, the first academic year in which the NCES collected data on distance education.

Distance education may involve communication through video, audio, or computer technology or by correspondence. Online courses were by far the most commonly offered in 2006–07, according to the data.

To learn more about distance education, visit nces.ed.gov/pubsearch/ pubsinfo.asp?pubid=2009044. For general information about NCES data, write to the center at 1990 K Street NW., Washington, D.C. 20006, or call (202) 502–7300. You can also e-mail associate research scientist Peter Tice at Peter.Tice@ed.gov.



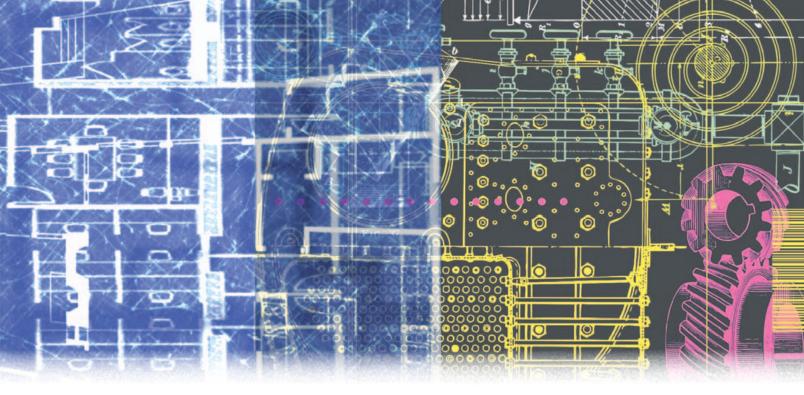
Patent Works The other side of invention

Tamara Dillon

In popular culture, the inventor is often portrayed as a lone tinkerer who emerges from a workshop with some magnificent new device. In reality, most inventions are the collaborative effort of scientists and engineers—usually researchers affiliated with a college or corporation—that result in the discovery, creation, or improvement of either products or processes.

But how do inventors know if their idea is original? And how do they preserve their right to a stake in its success? Answering those questions is at the core of what patent workers do. Patent examiners, agents, attorneys, and technology specialists help inventions advance from concept to conclusion while ensuring proper credit and compensation for the inventors.

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This article describes the jobs of patent workers. The first section provides a brief overview of the patent system. The second section describes the work, wages, and training for each of the occupations. A final section suggests sources of additional information.

Invention and patents: An overview

An invention is a type of intellectual property—that is, a product of original, creative thought. If an invention has not yet been publicly disclosed or recorded as unique, it might be eligible for legal protection in the form of a patent.

Patents are awarded for the creation or discovery of processes, machines, manufactured articles, or chemical compounds. New improvements of any of these can also be patented. But not everything is eligible. To be awarded a patent, a creation, discovery, or improvement must meet certain criteria. Specifically, it must be new, useful, and not obvious to someone with ordinary knowledge in the subject area.

Inventors don't automatically receive patents for their work, of course; in the United States, they must file an application with the U.S. Patent and Trademark Office, part of the U.S. Department of Commerce.

An applicant must provide a detailed description of the creation or discovery being claimed as an invention. Successful applications result in a patent for the inventor. But if an application fails to show that the creation or discovery meets the required criteria, it is rejected. The inventor then can either appeal the rejection decision or amend the application and resubmit it for consideration.

A patent gives its holder the right to exclude others from making, using, selling, or importing the invention for a limited period. Without this exclusive right, inventors' work could be financially exploited by others. Inventors would therefore be reluctant to take on the effort and cost of inventing, or they would be unwilling to disclose their inventions. Governments grant patents to encourage scientific and technological research and to ensure that the results of this research become part of the public record.

Occupations in patent processing

Patent examiners review inventors' applications and decide if a patent should be awarded. To help navigate the application process, inventors may hire a patent agent or patent attorney. And patent technology specialists

advise patent attorneys on the technical or scientific details of an invention.

Patent examiners

A patent examiner reviews patent applications and determines whether they meet the approval criteria. The examiner first verifies that an application is for a single invention, not a combination of inventions. Next, the examiner searches internal patent databases, as well as published scientific and technical literature, for any public information related to the inventor's claim.

The purpose of this search is to establish that the discovery or creation is "new and inventive." If those criteria are not met, the application is rejected. It is common for an examiner to initially reject many parts of an application, usually because he or she feels that a prior discovery too closely matches a claim in the application. Applications, or parts of applications, may also be rejected because the examiner determines that the invention is not useful, or that it is obvious to someone with ordinary knowledge in the technical subject area.

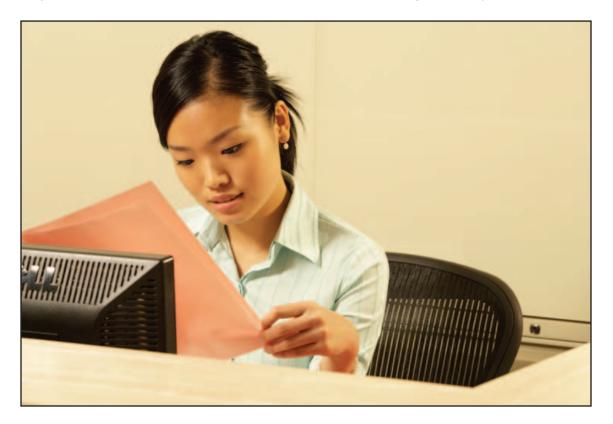
The examiner communicates his or her findings to the applicant or, more often, to the applicant's patent agent or patent attorney. (The job descriptions for patent agents and attorneys begin on the facing page.)

In the course of their work, patent examiners also consult legal and technical documents to evaluate claims. They often collaborate with other patent experts before making a final decision. And they write reports that detail the results of their research.

Employment and wages. Most patent examiners work at the U.S. Patent and Trademark Office near Washington, D.C. This agency employed about 6,000 examiners in 2008, accounting for nearly two-thirds of total employment at the Office. Depending on its budget, the Office expects to hire many more examiners through 2013. The additional examiners will help process a significant backlog of patent applications.

Wages of patent examiners are based on a specialized version of the Federal general schedule (GS) pay system. Examiners are recruited at grades GS-5 through GS-9. In 2009, annual wages for entry-level examiners

Patent examiners use research skills in reviewing applications.



in these grades start at \$41,350 at the GS-5 level to almost \$59,970 at the GS-9 level. The grade at which examiners are hired is based on both the applicant's experience and the scientific discipline in which he or she will work.

Qualified applicants also may be eligible to receive a recruitment incentive of up to \$9,900 per year for a maximum of 4 years. The incentive amount and duration are determined by title and grade level, as well as budget constraints.

With satisfactory job performance, examiners receive a one-time accelerated promotion to the next grade after 6 months. Annual promotions follow to the GS-13 level, at which wages are between \$93,920 and \$122,100. Examiners may then be promoted to "primary examiner" positions at the GS-14 level (about \$110,990 to \$144,280), following a rigorous evaluation program and testing. Positions at the GS-15 level (\$130,550 to \$153,200) are usually supervisory, and examiners must compete for open vacancies.

Training. Patent examiners need solid communication skills to confer with other patent practitioners and with applicants. They also must have knowledge of patent law; science, including advances in scientific research; and the technical processes used in industry. Because examiners make judgments in reviewing applications, they must be decisive. And patent examiners, like most Federal government employees, must be U.S. citizens.

Most patent examiners have a bachelor's or master's degree in engineering or science. After they are hired, patent examiners attend the U.S. Patent and Trademark Office Patent Training Academy, an 8-month program that provides comprehensive training in the procedural, legal, and technological aspects of patent examination. Students learn the research tools and methods they will use as examiners and develop the writing and interpersonal communication skills they need in their work.

The academy also creates an individual development plan for each examiner, based on his or her skills, knowledge, and experience.

This plan includes 2 years of ongoing training and developmental assignments. Examiners receive additional on-the-job training from an experienced supervisory patent examiner when they complete their academy study. And examiners keep their training current by periodically taking U.S. Patent and Trademark Office courses in legal and scientific topics.

Full-time permanent employees with at least 2 years of continuous service can participate in a special legal studies program, provided that the legal education is related to their mission at the Office. Upon acceptance to an accredited law school, participants are reimbursed for a specified number of credits within a 6-year period. In return, participants commit to working at the Office for a certain amount of time after completing their studies. (Like all incentive programs, however, this one is also subject to funding.)

Patent agents and attorneys

Because the patent application process is complex, many inventors rely on the expertise of patent agents and patent attorneys. Agents and attorneys—collectively referred to as patent practitioners by the U.S. Patent and Trademark Office—have essentially the same role in preparing patent applications and acting as a liaison between inventors and patent examiners. But attorneys perform additional tasks related to protecting inventors' patent rights, including negotiating licenses and defending against infringement.

Either agents or attorneys can represent clients in proceedings with the U.S. Patent and Trademark Office. The goal of practitioners is to smooth the progress of patent examination, so much of their work is similar to that of patent examiners: They search for prior art—public information that is relevant to the patent—and ensure that there is a legal and scientific rationale for an applicant's claims. Patent practitioners also talk with other inventors, or those who own rights to an invention, to understand both the science or technology behind the invention and ways in which the invention is new and unique—and, thus, eligible for a patent.

The practitioner drafts the patent application, describing the invention and claiming legal protection for it. The description must be written in a way that will enable others to use the invention; the claims must explain precisely what the patent would exclude others from making, using, or selling without permission. In preparing the application, patent practitioners try to anticipate the questions or objections examiners might raise.

The application is then prosecuted, which means that the practitioner submits it and sees it through to conclusion. This includes preparing responses to an examiner's rejection, either by amending the application, appealing the examiner's decision, negotiating with one or more examiners, or any combination of these.

Both patent agents and patent attorneys can prepare and prosecute patent applications. But only patent attorneys may give advice on legal matters or represent clients in legal proceedings.

Patent attorneys negotiate and draft legal documents that license use of inventions. Licensing documents detail the specific uses that are allowed and prohibited, as well as the compensation to be paid to the holder of the patent. Patent attorneys represent patent holders or those seeking permission to use an invention.

Patent attorneys also represent clients who feel that their patent has been infringed or who are accused of infringing the patent rights of others. In arguing that patent rights have been infringed, an attorney may request that the infringement be stopped or may seek monetary damages. When defending clients against accusations of patent infringement, an attorney compiles evidence to show that infringement has not occurred or challenges the validity of the patent itself.

Employment and wages. The U.S. Bureau of Labor Statistics (BLS) does not collect employment data on patent agents. Although BLS does collect data on attorneys, it does not collect data specifically on patent attorneys. However, according to the U.S. Patent and Trademark Office, there are about 9,400

active patent agents and about 29,000 active patent attorneys with licenses to practice before the Office.

Patent agents and attorneys work primarily in the private sector. Most work for intellectual property law firms, but they may also work for corporations, universities, or other organizations that research and develop inventions or purchase the rights to inventions. A small percentage of patent agents and attorneys are self-employed and seek clients who want to apply for patents. Patent attorney positions are also available with the Federal Government.

Patent attorneys may work for law firms that specialize in intellectual property law or for general practice firms that have an intellectual property law department. Patent attorneys usually have a scientific or technological specialty and often work for a firm focusing on that specialty. Law firms' patent attorneys handle most intellectual property litigation.

Many corporations hire patent attorneys as in-house counsel. These lawyers develop expertise in the corporation's technology and are often involved in business decisions related to intellectual property. When outside counsel is required, such as in matters of litigation, corporate intellectual property lawyers frequently work with attorneys in law firms who have additional expertise.

In the Federal Government, the U.S. Patent and Trademark Office is the principal employer of patent attorneys. These attorneys usually focus on analysis related to developing public policy concerning patents. They might create legislative proposals seeking changes in patent law, for example, or make recommendations on the intellectual property aspects of trade agreements. Other Federal agencies may employ patent attorneys to advise or represent them in intellectual property matters.

Colleges and universities occasionally employ patent attorneys to advise them on matters concerning research conducted at the university. Law schools also employ patent attorneys in teaching positions.



Unlike patent agents, patent attorneys may advise or represent clients in legal matters.

BLS does not have wage data for patent agents. According to an American Intellectual Property Law Association 2009 report, however, the annual income for patent agents in 2008 ranged from \$110,000 to about \$121,800. Wages vary and depend on factors such as the agent's educational level and scientific discipline. Also contributing to wage differences is the type of organization in which the agent works, with law firms usually paying the most. And, just as in most other occupations, wages vary with experience and by geographic location.

BLS does collect wage data for attorneys, although not specifically for patent attorneys. Median annual wages for all attorneys in May 2008 were about \$110,590. But it is likely that the complexity of patent law, and the scientific knowledge it requires, places patent attorneys among the highest earning 10 percent

of lawyers, whose median annual wages were \$166,000 or more in May 2008. The American Intellectual Property Law Association study showed that members who were partners in private law firms had an annual income of \$415,000 in 2008.

Training. Both patent agents and patent attorneys must be organized, detail-oriented, and able to meet deadlines imposed by the patent office. In addition to having a thorough understanding of the technical and scientific areas in which they work, patent practitioners should also understand how patent law applies to this science. Interpersonal skills are important for negotiating with patent examiners, clients, and others involved in the patent process; oral and written communication skills are a must.

Patent attorneys need additional expertise and skills related to intellectual property and the practice of law. They must be experts in intellectual property, able to analyze and resolve patent prosecution, litigation, copyright, and related legal issues. And although patent attorneys must be capable of arguing in court, the most common—and preferred solution is to settle a case without going to trial.

Patent practitioners need a bachelor's degree in science or engineering. Additionally, patent attorneys must have a juris doctor degree from an accredited law school and be admitted to a State bar.

To represent clients before the U.S. Patent and Trademark Office, both patent agents and patent attorneys must be licensed with the Office. Licensure requires achieving a passing score on the Office's registration exam, also known as the patent bar. However, patent examiners with 5 years of continuous service at the Office may register as patent agents without taking the registration exam.

Patent technology specialists

Patent technology specialists usually work as technical or scientific advisers under the supervision of patent attorneys. Because of their expertise, specialists perform research and deal directly with inventors to better understand an invention, how it operates, and its patentability—as well as the likelihood that the invention may infringe other patents.

After gathering facts about an invention, patent technology specialists analyze the information and communicate findings to a patent attorney. They might also draft, or help to draft, patent applications and may be involved in the technical aspects of defending a client's patents or challenging patent applications for similar creations or discoveries.

Employment and wages. BLS does not collect data on the employment or wages of patent technology specialists. Industry sources suggest that, like patent agents, patent technology specialists usually work for intellectual property law firms or for the intellectual property departments of large general practice law firms. And their wages are similar to those of patent agents.

Training. Patent technology specialists need at least a bachelor's degree in a technical or scientific discipline. An advanced degree may be required to work at some firms and in certain technological and scientific areas. The emphasis on scientific training underscores the technical expertise that specialists provide.

Working as a patent technology specialist is often a path to obtaining a law degree and becoming a patent attorney. Because most law firms expect technology specialists to attend

Patent technology specialists have expertise in the scientific details of inventions.



law school, firms encourage and frequently subsidize specialists' legal education.

for more information

Learn more about the job of patent workers by visiting your local library or searching online for information about patent, trademark, and copyright law.

In your research, you might come across information from BLS. The Occupational Outlook Handbook, available in many libraries, includes a profile of lawyers that describes their job duties, training, wages, outlook, and more. And the Career Guide to Industries has similar information about occupations in the Federal Government, where most patent examiners work. (Online, see www.bls.gov/oco/ocos053.htm and www. bls.gov/oco/cg/cgs041.htm, respectively.)

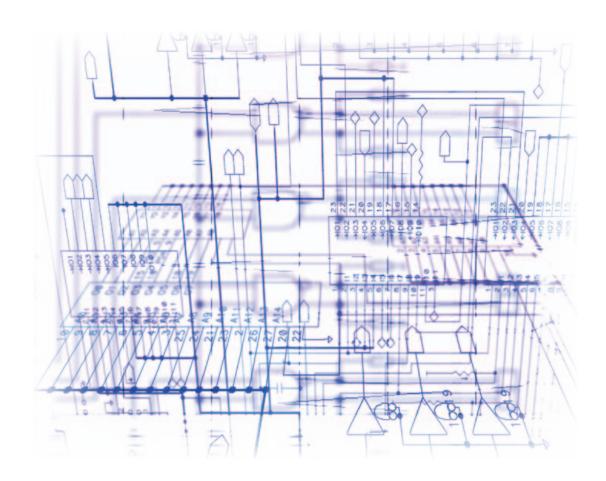
For information about opportunities in the U.S. Department of Commerce Patent and Trademark Office, call its contact center at (571) 272-1000 or toll free, 1 (800) 786-9199. To find job postings in the Office, visit its search page at USAJobs online:

http://jobsearch.usajobs.opm.gov/a9pto. aspx.

For information about patent technology specialists, patent agents, and patent attorneys, including requirements for taking the patent bar exam, contact:

American Intellectual Property Law Association 241 18th St. S. Suite 700 Arlington, VA 22202 (703) 415-0780 aipla@aipla.org www.aipla.org

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Elka Maria Torpey

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fter high school, Matt Hendren needed a break. "I'd had a really full -academic year," he says. "I was a little burned out and not so eager to get to the next academic step. I knew that I wanted to go to school, but I wasn't fired up about it just then."

So Hendren deferred his admission to the University of North Carolina and spent 2 years working for City Year Boston, an AmeriCorps-funded program. The experience, he says, helped to reinvigorate him and get him excited about returning to school.

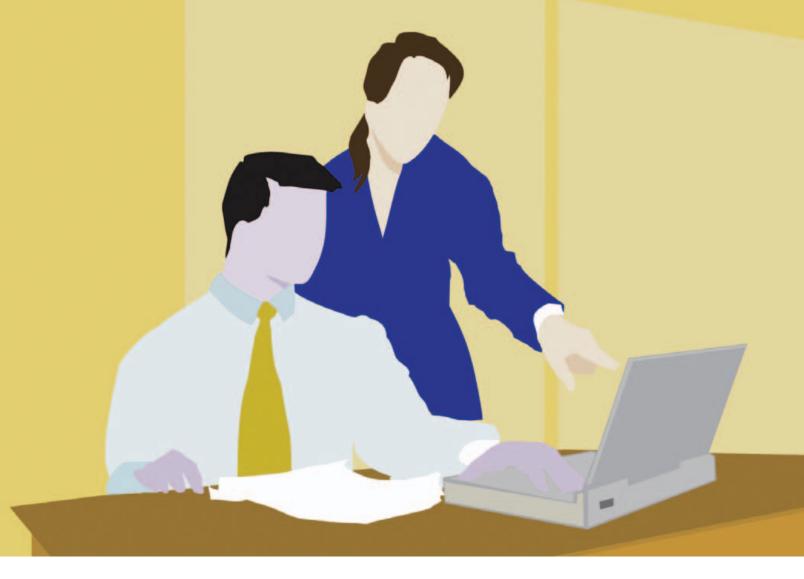
People like Hendren take time off from school or other endeavors for different reasons—and at different points in their lives. This transitional period is often called a "gap year." A gap year allows people to step off the usual educational or career path and reassess their future. And according to people who've taken a gap year, the time away can be well worth it.

This article can help you decide whether to take a gap year and how to make the most of your time off. The next few pages describe what a gap year is, including its pros and cons. Another section has tips for planning a successful year off. Suggestions for more information begin on page 31.

To gap—or not to gap?

"Gap year" often refers to postponing continued study after high school. It can also be a break during or after college or graduate school—or at almost any other time. The practice is common in the United Kingdom and other countries and increasingly familiar in the United States.

Although termed a gap year, the time period can be longer or shorter than 12 months. The concept of a gap year is flexible in other ways, too. "Gap year is a state of mind," says college career counselor Marianne Green. "It's a way of choosing an



activity and using that experience in a way that is helpful for the future." Just about anything, from working on a dude ranch to working in a local store, can be turned into an interesting gap-year experience, says Green: "What's important is the attitude that you have."

Some gap years are unforeseen. A student graduating from college might, for example, have difficulty getting a full-time position in his or her field of study. Or family obligations might prevent someone from attending college. Other gap years are more deliberately chosen.

Regardless of the circumstances leading to it, says Green, a gap year should be an intentional undertaking. "It's not a default," she says. "The bottom line is that maybe you didn't get into law school or maybe the job in an accounting firm fell through. But you can consciously choose to make your time off the very best experience you can."

Pros and cons of a gap

A gap year can be a rewarding experience; however, it is not without potential drawbacks. Learning about the pros and cons can help in the decision-making process.

Discussing the possibility of a gap year with school counselors, family, and friends is helpful when considering the implications of taking time off. But in the end, the decisions about how to time an education or career belong to the person taking—or not taking a year off.

Pros. There are many benefits to taking time off. A gap year can provide experiences that help people gain insight about themselves and their goals. It can give students a break from the pressures associated with academics, resulting in renewed enthusiasm for their studies when they return to school. And it can offer young people real-world understanding of their classroom-based learning.

For some students, a gap year helps to prepare them for future studies. "I feel so much more ready for college now than when I first graduated," says high school graduate Macauley O'Connor, who spent last year in Japan and China on a gap year arranged by the Center for Interim Programs. "I learned more about, and I have a better perspective on, myself and the world."

Taking time off before going to school also provides a chance to earn money for tuition and other expenses—in fact, more than 80 colleges and universities now offer grants to students who defer their studies to participate in AmeriCorps—and can help people decide what they want to do. Sarah Kohut, for example, traveled and worked after earning an undergraduate degree, using her time off to earn a little money as she considered her career options. After job shadowing and working in a preschool and in retail, she returned to graduate school to study counseling in higher education. "I'm so glad I did it," she says of



her gap. "I needed the time to figure things out."

Kohut's career plans—and the students she will eventually counsel—benefit from the time she took to consider her own goals. That may be a common result, according to an independent study of 300 gap-year participants between 1997 and 2006. "Long-term, students who took gap years overwhelmingly were satisfied with their jobs," says Karl Haigler, one of the authors of the study. Gapyear participants' sources of job satisfaction, he says, were most often driven by their ability to help others.

Hendren, for one, is glad he spent his gap that way. "The value of doing service work is very important," he says. "And, at age 18, knowing that your contribution to the world can be meaningful—that's something that a lot of folks don't get."

Cons. Gap years also have drawbacks. Postponing school or work takes people off of a more traditional path, and it's sometimes challenging to get back on. If not carefully planned, a gap year might seem too unstructured, and people can become frustrated if they feel that they aren't putting their time to good use.

Once students get out of the routine of academics, returning to school can be difficult. A June 2005 study by the U.S. Department of Education's National Center for Education Statistics found that students who delayed enrolling in college were less likely to earn a postsecondary credential than those who went directly from high school to college.

However, the Department of Education study included all students who didn't go directly to college; it did not examine the experiences of gap-year students who elect to temporarily postpone college and have a specific plan for that time. Haigler's study, although smaller by comparison, specifically considers that group. And his study found that the majority of students who take an intentional, planned gap year return to school to continue their studies.



But even those who do return to complete their education point to some of the challenges that arise. "It's difficult to readjust to being at school because you've been on your own, doing something that has an impact," says Hendren. "You're not exactly in the same place as everyone else."

You also might not be in the same place as your peers when competing for future educational or career opportunities. Although many colleges and employers look favorably on a well-structured gap year, others may take issue with the break in continuity. Gap-year participants should be prepared to answer questions from school representatives and prospective employers about what they did during their gap year and how their experiences influenced them.

Taking a gap year isn't for everyone. People who aren't fully committed to their reasons for taking a gap year might not be happy with the experience. For example, students shouldn't pursue a gap year simply to procrastinate applying to schools or because someone else thinks it's a good idea. A year is

a long time, so carefully choosing activities is essential.

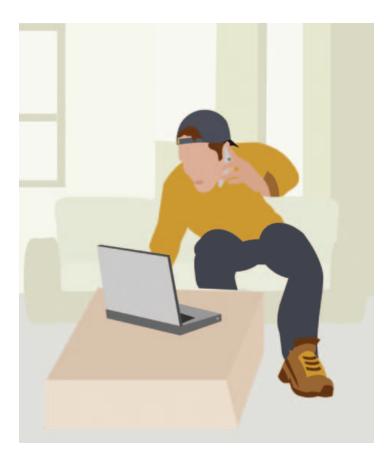
Planning a gap year

Experts say that the most important part of a successful gap year is to have a plan. The more people look into their options and understand the consequences—good and bad of taking a gap year, the happier they are with the outcome.

"Preparation is critical to having a good gap year," says career counselor Green. Those who have taken a gap year agree. Kohut, for example, started her gap years not knowing exactly what she was going to do and acknowledges that she could have done a better job of planning beforehand.

Before deciding to take time off, it's helpful to think about what to do prior to leaving school, expenses associated with a gap year, and activities and goals for the time off.

Tasks before leaving school. Potential gap-year participants who are still in school should do several things to ease their post-gap return.



If students plan to pursue an undergraduate or graduate education, ideally they should apply to schools, be accepted, and then ask for a 1-year deferment, experts say. This is especially true at the undergraduate level, where many schools allow or even encourage students to defer their admission. Students who have been awarded scholarships and defer admission are often allowed to retain them after a gap. Each school sets its own deferral policies; students should familiarize themselves with the rules at the ones that interest them.

Students are also advised to get references and take school admissions tests—such as the SAT or the GRE—before leaving school. Gap-year participants usually have less access to high school or college guidance offices that help with school applications, career or educational counseling, and job placements, so consider visiting these offices before leaving campus.

Expenses. It is also important to look into the costs associated with time off. Costs can include not only living expenses but also health insurance premiums, because coverage usually is not available through parents' plans for adult dependents who are no longer students. To mitigate the risks associated with this loss of insurance, temporary insurance is available. But this option is usually expensive.

Working full or part time is one way to earn money for gap-year travel and other activities, and many jobs provide insurance and other benefits. Service programs might offer a stipend and pay for housing, education, and other costs, but participants often must learn to get by with less than they are accustomed to. Some businesses and consultants specialize in arranging gap years, but many of the programs require payment to cover participants' expenses—which may include transportation, lodging, and food—that add to the cost of taking time off.

Activities and goals. Although some people might view the gap year as an escape from a structured environment, the better organized a gap year is, the better the experience promises to be. Start getting organized by determining the types of activities to be pursued and the overall goals for the time off.

For example, a recent college graduate might work with a volunteer teaching organization to test his skills, and consider his potential, as a teacher. Or a high school graduate might travel and work in restaurants, taking a break from her schooling to get handson experience useful for deciding whether to study hospitality management in college.

People often do more than one activity during their gap year; for example, they might travel for several weeks and then get a job or they might participate in a service program while taking a class in an area of interest. Some gap-year participants do different activities during the fall and spring, breaking up their time like a college semester, sometimes with another activity during the summer and winter breaks.

Popular options for gap-year activities include travel or cultural immersion, volunteering, public service work, and fullor part-time jobs or internships. Service

organizations, such as AmeriCorps, are a good source to begin research. The AmeriCorps Web site, for example, allows people to search for programs by area of interest and State. (For a list of other organizations that offer possible gap-year experiences, see the box on pages 32–33.)

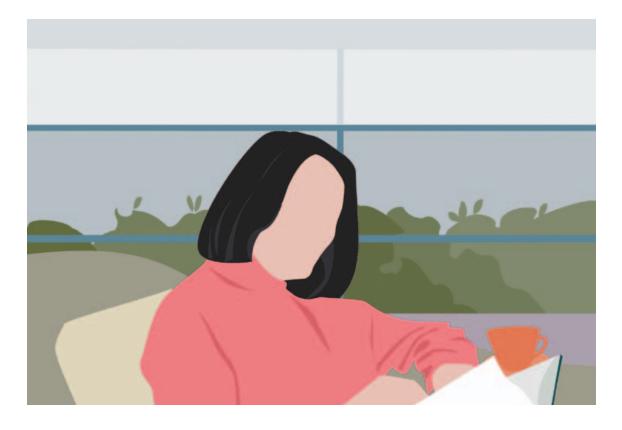
Almost anything can make a gap year rewarding, say experts, so long as the time is well planned. What is important is that the chosen activity or activities be of interest and benefit the gap-year participant in some way. Each person's experience will differ.

Likewise, the sources of satisfaction will vary. For some, it's the sense of accomplishment they get from following a different path. "The best part," says Kohut of her 2-year break between undergraduate and graduate school, "is being able to say that I did it. I went out there on my own, kind of against the grain, and I made it."

More information

Students should visit their school's career guidance office to find out more about gap years and possible gap-year activities. Public libraries have books about travel, internships, careers, and other subjects that might be helpful to people considering what to do during their time off. And One-Stop Career Centers have information on short-term job, service, and internship opportunities. Find a center near you by visiting www.servicelocator. org or calling toll free, 1 (877) 348–0502 or TTY 1 (877) 348-0501.

Career seekers sometimes take a gap year to help them determine the type of work they're interested in doing. You can explore career options without taking a gap year—or even if you decide to take time off—by using the Occupational Outlook Handbook or Occupational Outlook Quarterly, available online at www.bls.gov/ooh and www.bls.gov/ooq, respectively. The Handbook provides nearly 300 occupational descriptions, along with detailed working conditions, earnings, and job outlook information. The Quarterly explores work and careers through a variety of topics.



Creating the perfect gap year: Locating gap-year activities

Deciding what to do during a gap year requires identifying your interests and checking into available options. The Web sites listed below offer a place to start. They are not, however, the only sources of gap-year information. For example, faith-based groups might have service or volunteer opportunities. Many employers offer internships and jobs. And you can learn more about positions overseas in the article "Working abroad: Finding international internships and entry-level jobs" in the fall 2006 issue of the *Quarterly*, online at www.bls.gov/ooq/2006/fall/ art01.pdf.

Finances associated with gap-year activities vary. Many domestic service programs offer a living stipend, health insurance, and an educational award of up to \$4,725. Some provide housing or other benefits as well. International service opportunities can offer similar forms of assistance. Volunteer work is typically self-funded, while jobs, fellowships, and internships are often paid positions. And organizations that help plan a gap year usually charge a fee for their services, so be sure to look into their reputation.

This list is based, in part, on material originally published by the University of Delaware's Bank of America Career Center. Used with permission.

General resources

Idealist ServeNet www.idealist.org www.servenet.org

Domestic service

AmeriCorps State and National AmeriCorps Vista AmeriCorps NCCC **Public Allies** Teach for America City Year

www.americorps.org www.americorps.org/vista www.americorps.org/nccc www.publicallies.org www.teachforamerica.org www.cityyear.org

International service

Peace Corps **United Nations Volunteers** www.peacecorps.gov www.unv.org

Volunteer

Serve.gov Global Volunteer Network Peacework Development Fund Projects Abroad Global Service Corps United Planet

www.serve.gov www.volunteer.org.nz www.peacework.org www.projects-abroad.org www.globalservicecorps.org www.unitedplanet.org

Jobs, fellowships, and internships

Studentjobs.gov The Student Conservation Association U.S. Fish and Wildlife Service The Washington Center CORO Fellows in Public Affairs **Washington Semester Programs**

The Red Cross

Odd/Adventure jobs

Back Door Jobs Cool Works Outdoor Adventure Jobs Fun Jobs

Publication Title

Fall 2009

Occupational Outlook Quarterly Issue Date for Circulation Data Below www.studentjobs.gov www.thesca.org www.fws.gov www.twc.edu www.coro.org www.american.edu/washingtonsemester www.redcross.org

www.backdoorjobs.com www.coolworks.com www.oapn.net www.funjobs.com

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	ment of Ownership, Management, and Circulation	l			copies each issue during	copies each issue during
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1.		Occupational Outlook Quarterly			months	months
2.	Publication No.	492-690				
3.	e	October 1, 2009	a.	Total No. Copies (Net Press Run)	5,162	5,162
4.	Issue Frequency	Quarterly	b.	Paid Circulation (By Mail and Outside the Mail)		
5.	No. of Issues Published Annually 4 (1) Mailed Outside-County Paid Subscriptions Stated on Form 3541 (Include paid					
6.		\$15		distribution above nominal rate, advertiser's proof copies, and exchange copies)		3,140
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9.	Full Names and Complete Mailing Address of Publi	isher, Editor, and Managing Editor	d.	Free or Nominal Rate Distribution (by Mail and Outside the Mail)	3,724	3,724
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	U.S. Department of Labor, Bureau of Labor Statistic	cs		(2) Free or Nominal Rate In-County Copies Included on PS Form 3541	N/A	N/A
	2 Massachusetts Avenue NE., Washington, DC 202	12-0001		(3) Free or Nominal Rate Copies Mailed at Other Classes Through USPS	N/A	N/A
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	Editor: Kathleen Green			Total Free or Nominal Rate Distribution (Sum of 15d (1), (2), (3), and (4))	1,142	1,142
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	Managing Editor: John Mullins			Copies Not Distributed	96	96
	2 Massachusetts Avenue NE., Washington, DC 202	12-0001	g. h.	Total (Sum of 15f and g)	5,162	5,162
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You're a what?

Solar photovoltaic installer

s long as there's sunshine, Rebekah Hren expects to have an outlet for her work. Rebekah, a solar photovoltaic (PV) installer, puts solar panels on roofs and in other sunny places to turn the sun's power into electricity. She enjoys promoting renewable energy, in part because it's an emerging field. "It's a fun industry to be in right now," says Rebekah. "It's kind of like the Wild West."

In solar PV systems, solar cells—devices that convert sunlight into electricity—are joined to create different types of solar modules, which are usually further connected. Solar electric systems can be installed on the ground, on poles, or on the roofs or sides of buildings.

The most common type of solar modules is the 3- by 5-foot flat, framed solar panel that is mounted on top of a roof. But solar cells are also manufactured as flexible panels, roof tiles, and shingles. Other cells may be integrated with building materials, such as siding or windows.

Most of Rebekah's installations are on the roofs of houses. Atop a roof, her first order of business is to make sure that there is enough room for the panels and that the roof can hold the weight of the system. If the roof meets both criteria, Rebekah bolts structural framing, or racking, to the roof. Next, she attaches the panels and connects them with wires.

The wires are then brought down to a basement, garage, or outside box to be hooked up to an inverter, which turns the direct current (DC) generated by the solar cells into an alternating current (AC) that can be used to power homes and businesses. Some systems include battery backup to store electricity for later use.

The wiring of the inverter to the utility box and main electrical grid must be done by a licensed electrician. In fact, some municipalities require that solar PV installers have an electrician's license. Rebekah has a license, so she does the wiring on her installations.

Each installation is unique, especially in residential work. That one-of-a-kind feel to

every job keeps it interesting, Rebekah says: "Installation never goes flawlessly, so there's always something new or different to consider." For example, installers might need to reinforce a roof that isn't strong enough to hold the panels. Or they might alter their design to work around a chimney.

Before finishing, installers activate the system, check that it's working correctly, and help with site cleanup. Lead installers or those who have an electrician's license might be responsible for arranging work permits and inspections, or they may work with utility companies to connect the system to the main electrical grid. Some installers also repair solar electric systems that are already hooked up.

For Rebekah, a typical residential installation takes about 3 days, and she spends half of that time placing the modules. Large, commercial installations may take several months. As a result, work schedules of solar PV installers can be similar to those of construction workers, with long hours on some days followed by periods of no employment.

Also like construction workers, an installer's days often start early to beat the worst of the heat. And their work depends on the sun in more ways than one. "If it's raining, a lot of times I can't work," says Rebekah. That's because wet weather can make installation dangerous. Working up high requires taking special precautions, such as wearing a harness, but safety equipment is often no match for hazardous outdoor conditions.

The U.S. Bureau of Labor Statistics does not publish employment data on solar photovoltaic installers. But industry sources suggest that there are about 7,000 solar photovoltaic installers—who may also be known as solar photovoltaic technicians or solar installer-roofers—in the United States.

About half of all solar PV installers work in California, a State that provides many incentives for solar electric power. Because solar power requires a large upfront investment, tax credits and other government incentives help

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make it a more affordable option for individuals and businesses. Given the trend in favorable government incentives, analysts expect that the solar-power industry will continue to grow rapidly.

As the use of solar power expands, the job tasks of solar PV installers are evolving. Some workers concentrate primarily on installing the panels. Others, especially those at small companies, do everything from sales to planning to wiring. Experienced installers in any size company may advance to lead installer, system designer, sales representative, or other positions.

Solar PV installers need mechanical skills and must be able to work with the power tools and hand tools used to construct and fasten equipment. Electrical knowledge and an understanding of basic math are helpful, as are good problem-solving abilities. Attention to detail is important, because completing an installation often requires following diagrams and instructions. Heavy lifting is also required at times: Solar panels typically weigh between 30 and 40 pounds; batteries can weigh double that or more.

And workers can't be afraid of heights. Although most commercial installations take place on flat roofs, many residential installations take place on pitched roofs often with a steep slope—and on loose or

fragile materials, such as cedar shake and clay shingles. "The scariest part of the work is being up on the roof," says Rebekah. "You have to be a certain type of person to climb up on roofs and do high-voltage electrical wiring."

Most solar photovoltaic installers have a high school diploma and mechanical, electrical, or related experience. People with construction backgrounds are often well suited for the work; roofing experience is particularly valuable. Some employers prefer to hire applicants who have an associate degree in an electrical or related field.

Rebekah says that solar panel installation also attracts career changers from a variety of fields. New workers frequently learn on the job, although specific training in solar installation or solar power is helpful. Voluntary certification is also available and is sometimes required.

Industry analysts estimate that wages for entry-level solar PV installers are about \$12 to \$15 an hour and vary by location, with crew leaders making between \$20 and \$25 an hour. Workers with an electrician license or other qualifications typically earn more.

But for Rebekah and other solar PV installers, their work isn't just about earning a paycheck. "What I really love is installing a system and knowing that it will be creating clean energy for 25 years," says Rebekah. "It's exciting to be making a difference." ∞



Photo of Rebekah Hren courtesy of Honey Solar Electric, Inc.

Installing framed panels on rooftops is one of Rebekah Hren's many tasks.



Large occupations with higher-than-median wages

Some occupations pay well but employ relatively few workers. Others don't pay as well, but their employment numbers are larger. And some occupations have both large employment and high wages.

High-paying, high-employment occupations are a diverse group, according to May 2008 data from the U.S. Bureau of Labor Statistics (BLS). The chart shows the occupations with the highest employment levels in which median wages were above \$32,390—the median annual wage for all occupations.

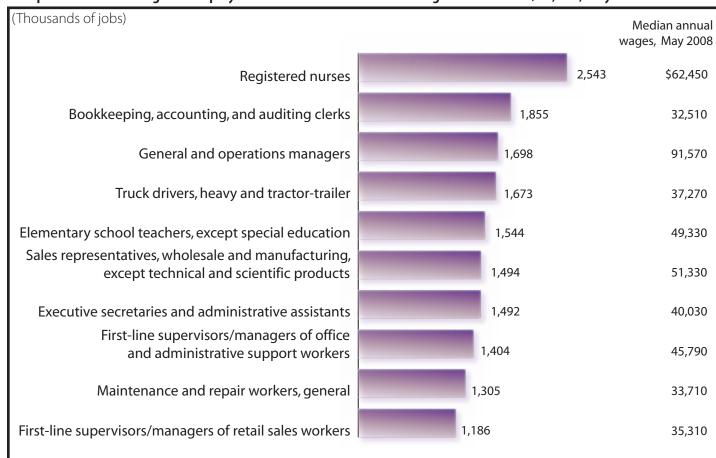
Because employment numbers in these occupations are so large, many of the job openings projected over the 2006–16 decade will result from the need to replace workers who leave the occupation because of retirement or other reasons. But opportunities are also expected to arise from employment growth. Employment of

registered nurses, for example, is expected to grow by 23 percent over the projections decade.

Education, training, and work experience vary for these workers, too. Elementary school teachers, for example, usually need at least a bachelor's degree. In contrast, the most significant source of education or training for general maintenance and repair workers is experience in a related occupation.

Employment and wage data in the chart come from the BLS Occupational Employment Statistics program; to learn more, visit www.bls.gov/oes or call (202) 691–6569. For information about occupational projections or training, visit the BLS Employment Projections Web site, www.bls.gov/emp, or call (202) 691–5700. Or write to either program at 2 Massachusetts Avenue NE., Suite 2135, Washington, D.C. 20212.

Occupations with the highest employment levels in which median wages were above \$32,390, May 2008





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You're a what?

Solar photovoltaic installer

page 34

